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REPORT OF INVESTIGATIVE PROGRAM OF THE
BUREAU OF ENTOMOLOGY,
Forest Insect Field Station, Coeur d'Alene, Idaho

The investigative program of the Coeur d'Alene station has been continued with few changes during the past year. As in the past, the economic importance of the mountain-pine beetle problem has resulted in practically the entire investigative strength of the station being directed toward its study. The objective of this project is to develop more effective and economic methods of bark beetle control and to understand more clearly the effect which the different forms of artificial control have upon the environmental factors of the region concerned. In developing a method of control, its effectiveness in eliminating the destructive pest, its effect upon the beneficial parasites and predators, its feasibility or ease of application, and necessarily the cost of operating, are all basic fundamentals that must be carefully considered. Though new methods of control are desired, present methods are being carefully studied in the hopes that objections relative to cost and difficulties of operation can at least be partially overcome. Perhaps one of the most difficult phases of forest insect control is the part which the human element plays in its success or failure. Employees by becoming derelict in their duty can often turn an otherwise successful project into a failure, and the method of control considered as being at fault. A summary of the past season's work will contain no startling innovations; however, valuable information has been secured which has already been adapted to our work and will serve in directing further study. A resume

of the status of the investigative projects assigned to the Coeur d'Alene station follows:

1. Artificial Control of the Mountain-Pine Beetle

Other suggested leads being exhausted the work in connection with this project has been concentrated upon what has become known as tree medication. In 1931 a number of infested lodgepole and white pine were treated with different strength solutions of sodium arsenate. As in previous experiments, an even distribution of the poison had been difficult to secure, different dosages of wood alcohol and denatured alcohol were used in association with the arsenate to determine if they would act as a solvent to the pitch within the cellular structure. From previous experiments it had been found that the effects of medication could not be measured until the following spring. Trees treated in 1930 and examined late the same season showed very unsatisfactory results; however, trees treated at the same time and examined in the spring of 1931 showed a 100 per cent mortality of the insect broods. Apparently the poison established an abnormal chemical condition which though fatal to the developing broods of insects was slow in its lethal effects. Trees treated in the summer of 1931 were examined in the spring of 1932 with approximately the same satisfactory results. A few of the treated lodgepole trees did not show a 100 per cent mortality of the insect brood due to certain mechanical errors in the process of injection. These results seemed to offer rather positive confirmation as to the effectiveness of the method as used. At this time it would seem that this potential method of control has its greatest field in the treatment of white pine, where, under our present methods of control,

the cost per tree is sufficiently high to permit a substantial reduction in the cost of treatment. During the 1932 season additional treatments of infested white pine trees were made with the idea of determining how long after attack the medication will prove successful. Furthermore, trees were treated under all conditions of exposure, sites and elevations, to determine if there are any factors limiting the use of the method. Though an effective method of applying this poison has been developed, it is difficult to apply and requires a certain amount of skill; so before it can be adopted as a means of control, improvements in the technique of application must be made. With the method now in use a shallow saw kerf is made around the tree, below which a tin collar is tacked, forming a cup. The poisonous solution is poured into this cup, permitting a uniform absorption on all sides of the tree. The Coeur d'Alene station will be grateful for any suggestions as to how this method of applying the poison can be improved.

Confronted with severe outbreaks of the mountain-pine beetle in lodgepole pine, where the institution of direct methods of control are no longer economically feasible, the preserving of trees with high aesthetic value from the attacks of these insects is now an important problem. Last season a series of chemicals were used as sprays in an effort to immunize trees from insect attacks. Though some success has accrued from these experiments, no positive recommendations can be made. The difficulty of immunizing a tree from insect attack increases with the severity of the threatening infestation. With outbreaks such as we are now experiencing in Montana and Idaho, the task is an extremely difficult one. With an unlimited supply of host material it is relatively easy to deter the attacks of bark beetles. However, when a shortage of host material exists, such immunization

is far more difficult to secure. Further tests will be conducted during the coming season.

2. Bark Beetle Control

This project, dealing with the economic phases of bark beetle control, has as its objective the reduction of operating cost with an increased efficiency of the results secured. During the past season an attempt was made to study the going control projects of the district for the purpose of securing data relative to improvements in project administration, crew organization, etc. Though this study has not accomplished a great deal, the importance of the part which the human element plays in such operations is now more fully recognized than ever before. The need for emphasizing the quality of work rather than quantity, and the securing of such standards by adequate field supervision are fully appreciated. Poor work, the result of inadequate supervision, can easily turn an otherwise successful project into a failure. It is believed that the results secured are to a great extent directly comparable to the extent of the field supervision given to the project.

To check the effectiveness of spotting, some check surveys were made of areas spotted in the spring of 1932. These check surveys showed that only some 75% of the infested trees were being located by the average spotting crew. The organization was then changed to a six-man crew instead of a five, with the chief spotter working behind the crew in an entirely supervisory capacity. This method was practiced in the fall of 1932, and the efficiency of the crew increased to 85%. It is believed that this percentage can be still further increased through more supervision on the part of camp managers and insistance of a higher standard of work. The

difficulty of locating every infested tree is appreciated, but if public funds are to be spent for insect control a maximum standard of efficiency should be insisted upon and sufficient supervision provided to secure it.

Experimental combination spotting and treating crews were organized for the Bumble Bee drainage. These crews consisted of the regulation five-man spotting crew, with the addition of an extra man who followed the crew with a horse packed with necessary felling and treating tools. As infested trees were located they were felled and treated, and though the cost of operation was not greatly reduced the work must have been very efficient as a reduction in the infestation of 82% was secured.

The mountain-pine beetles overwinter as new adults, mature larvae, and small larvae. Overwintering new adults emerge and attack early in June, before the close of most projects. Spring peeling, though effective against the immature forms, will not destroy new adults. On the Yellow Dog area of the Coeur d'Alene, these overwintering new adults, escaping destruction, built the June attacks up to a point equal to the entire infestation on the area at the time control was instituted. To check the effectiveness of fall burning as a means of preventing such situations, control was instituted in this area in the fall of 1932. The infested trees were felled, hand logged into decks and burned.

To learn more of the dissemination of bark beetles, a factor which plays an important role in the formulation of all plans for control, airplane insect traps were used in a series of short flights over the Coeur-d'Alene Forest in July, 1932. Though a number of different insects were taken at varying elevations, no bark beetles were secured. To augment these data a number of weather vane insect traps were set on lookout peaks

on the Coeur d'Alene, Kaniksu, and St. Joe National Forests. A number of different bark beetles were taken in each trap, and a few mountain-pine beetles were secured from one trap on the Kaniksu Forest. These collections only show that these beetles do fly over timberless mountain tops, but do not tell how far such flights may be made. Plans for the coming season include some rather detailed trapping along open mountain ridges and in timberless regions between two infested areas.

The Beaverhead insect survey was again conducted, providing valuable information contributing to our present knowledge of the spread of mountain-pine beetle epidemics, period of time over which new attacks occur, severity of the devastation, etc.

3. Biology of the Mountain-Pine Beetle in its Principal Hosts

To assist in the development of more efficient control measures, the seasonal history of the mountain-pine beetle has been thoroughly studied during the past two years. It is now known that many occurrences which were previously believed to be abnormal are but regular steps in the seasonal history of this insect. It is now rather positively known that the attacking beetles (parent adults) emerge following their first attack and reattack another green tree, producing successful broods in both trees. Certain events in the seasonal history of this insect that have resulted in confusion to spotting crews have been clarified and can now be adequately explained. Such items as sex ratio, parthenogenesis, feeding and mating habits, etc., the knowledge of which is essential in securing a better understanding of this problem, have been studied, and answers obtained. The influence which different phases of control have upon those insects which are parasitic and predacious upon the mountain-pine beetle is now being studied. During

the spring control on the Coeur d'Alene, experiments will be conducted, from which it is hoped data will be forthcoming as to the advisability of not treating trees with broods of overwintering new adults, which are always heavily parasitized. An effort will be made to measure the part which these beneficial insects play in the results secured from control measures. It is believed that this agency is the most important factor with which to contend in measuring the results secured from control. This work will be carried forward as rapidly as possible.

As the host selection habits of this insect must now be considered in the formulation of all plans of control, steps are being taken to more thoroughly answer such questions. Preliminary caging experiments were conducted last season which indicated a decided preference by the attacking beetles for the host from which they had emerged. A more detailed and thorough plan of investigation will be conducted during the 1933 season.

4. Douglas-Fir Beetle Investigation

This project, which was instituted two years ago, was continued during the past season. The purpose of this study was to provide fundamental information relative to seasonal history, habits, parasites and predators, etc., from which sound methods of control might be developed. Splendid progress has been made on this project, and a rather detailed report covering the progress has recently been submitted to all interested agencies. This report contains a rather full account of all insects found associated with this beetle. The knowledge of the seasonal history of a very beneficial parasite has suggested a change in the time of applying our present methods of control, which would not only be equally as

effective in destroying the beetles but would result in preserving all beneficial insects. However, as such a change would call for the treatment of trees during June, it could only be practiced in areas where the danger from fire could be overcome. Information gained from this study has already been of service in connection with control projects instituted against this insect.

5. Biology of the Oregon Pine Engraver (Ips oregoni) and Associated Insects

Outbreaks of Ips oregoni, an insect usually considered as secondary in importance, in lodgepole pine and ponderosa pine reproduction and small trees up to several inches in diameter are not uncommon. Experience has shown that though these outbreaks are of rather short duration, severe devastation often occurs during this period. This study was instituted in 1931 for the purpose of securing a better understanding of the factors which contribute toward the development and cessation of these sporadic outbreaks, and to develop methods of control. In attacking this problem it was necessary to understand the very confusing seasonal history of this insect before the factors influencing such outbreaks could be understood and effective method of control developed. During the past two seasons these points have been fairly well established, and valuable information relative to habits, associated insects, etc., have been made available. A detailed report of this project is now being prepared, which will be forwarded to all interested parties.

6. Insects and Forest Fires

The phase of this economically important problem which the Coeur-d'Alene station has been permitted to study has been the interrelation of

fire-scorched ponderosa pine and subsequent insect damage. A small fire near Coeur d'Alene which occurred in September, 1928, offered a splendid opportunity to secure a better understanding of the different classes of fire injury in their relation to the death of trees in association with subsequent insect attack. The economic value of such data would be in the prediction of insect outbreaks following fires and the institution of subsequent salvage cutting. The outstanding result secured from this study is that the peak of the insect attack occurs the year after the fire and that fire injury to the root collar is a far more important factor in determining the death of the tree than an injury to the foliage. Furthermore, there was only a very small per cent of the trees attacked by insects that would not have died from the effects of fire along. A final report of this project has been prepared and forwarded to all interested agencies.

7. Biology and Control of the Spruce Budworm

This project, which has been directed against an outbreak of the spruce budworm in the Cody Canyon, Wyoming, for the purpose of developing a spray which would be satisfactory for the protection of forested areas of high aesthetic or commercial values, was practically discontinued during the past season. The trees around the "dude ranches" were treated with a standard spray formula for the purposes of protection only. One small test of a foreign commercial product was conducted which resulted in a 50% mortality to the feeding larvae.

For the past two seasons artificial control measures have been directed against an outbreak of the Douglas-fir beetle working in the Douglas-fir stands defoliated by the spruce budworm. This dual insect attack has complicated the situation in this region, and the outcome will

offer some conclusive data as to the course which should be followed for similar situations.

8. Forest Plantation Studies, Halsey, Nebraska

This project was instituted a number of years ago for the purpose of devising means of controlling certain insects which jeopardized the plans of forestation being carried on in that region. Satisfactory progress has been made with this project, though there is additional work to be done. The tip moth (Rvacionia frustrana bushnelli) an insect doing tremendous damage to the ponderosa plantations has been brought under control, through the introduction of a parasite (Campoplex frustranae) from Virginia. Furthermore, the danger from shipping tip moth eggs on nursery stock can be avoided by dipping the material before shipment.

There are other insects in these plantations which threaten to become equal in importance to the tip moth and which are exerting unfavorable influences upon the success of the introduced parasites. These insects are to be intensively studied during the coming season. Rather detailed reports covering all of the past work in connection with this project are soon to be issued and will be forwarded to all interested agencies.

9. Temperatures in Relation to Phenology

Temperature exercises a direct influence upon insect development. Both high and low temperatures are fatal to insect life. There are also zones of high and low temperatures where insect life is inactive, as well as a range of temperatures which are extremely favorable to insect development. Such temperatures play an important part in determining the seasonal

histories, number of generations, flights, etc. Considerable work has been done in correlating phenological events of plants and trees with different seasonal dates, as well as the interrelation of plants and insects. As temperature is the governing factor of both plant and insect development, an attempt is being made to determine the degree, duration, and occurrence of temperatures both favorable and unfavorable to plant and insect development, with the idea of being able to foresee such seasonal history events of insects, which govern the institution and cessation of control. Though this work was carried on during the past season, it will be impossible to draw any conclusions until several years' data have been secured.